

## WHAT IS CLAIMED:

1. Microcapsules having a core material encapsulated within a microcapsular shell, said core material comprises at least one active ingredient, wherein the microcapsular shell comprises at least one inorganic polymer comprising polymerized precursors obtained by in-situ polymerization of said precursors; wherein the concentration of the core material based total weight of the microcapsules is above 95% w/w.
2. The microcapsules of claim 1 wherein the concentration of the core material based total weight of the microcapsules is from 95% to 99% (w/w).
3. The microcapsules of claim 1 wherein the concentration of the core material based total weight of the microcapsules is from 95% to 98% (w/w).
4. The microcapsules of claim 1 wherein said core consists essentially of said at least one active ingredient.
5. The microcapsules of claim 1 wherein said core material is said at least one active ingredient.
6. The microcapsules of claim 1 wherein said core is a liquid core.
- 7.. The microcapsules of claim 6 wherein said liquid core is an oily core.
8. The microcapsules of claim 7 wherein said oily core is a solution, suspension or dispersion.
9. The microcapsules of claim 1 wherein the active ingredient is selected from sunscreen agents, dental agents, fragrances, perfume, colors and dyes, food colors, food additives, waxes, antioxidants, humidifiers, vitamins,

explosives, pesticides, biological molecules, drugs, catalysts, reagents, and mixtures thereof.

10. The microcapsules of claim 9 wherein said drug is selected from dermatological agents, anti-inflammatory agents, analgesics, anti-fungal agents, anti-biotics, anti-viral agents, anti-acne agents, anti histamines, skin whitening agents, anti-parasitic agents, muscle relaxants, steroids, hormones, astringents and mixtures thereof.

11. The microcapsules of claim 1 wherein said active ingredient is a sunscreen agent.

12. The microcapsules of claim 11 wherein said sunscreen agent is selected from a UVA absorber, a UVB absorber and mixtures thereof.

13. The microcapsules of claim 11 wherein said sunscreen agent is selected from octylmethoxy cinnamate, 3-butylmethoxydibenzoyl methane, benzophenone-3, benzophenone-1, benzophenone-2, benzophenone-4, benzophenone-6, benzophenone-8, 2-ethylhexyl p-methoxycinnamate, p-aminobenzoic acid, 2-ethylhexyl N, N-dimethyl-p-aminobenzoate, 2-cyano-3, 3-diphenylacrylic acid 2-ethylhexyl ester, 2-ethylhexyl-2-cyano-3,3-diphenylacrylate, oxybenzone, 2-phenylbenzimidazole-5-sulfonic acid, homomenthyl salicylate, octyl salicylate, 4,4'-methoxy-t-butylidibenzoylmethane, 4-isopropyl dibenzoylmethane, 3-(4-methylbenzylidene) camphor, 3-benzylidene camphor, triethanolamine salicylate, 4-N,N-(2-ethylhexyl)methyl aminobenzoic acid ester of 2,4-dihydroxybenzophenone, 4-N,N-(2-ethylhexyl)methyl aminobenzoic acid ester of 4-hydroxydibenzoylmethane, 4-N,N-(2-ethylhexyl)methyl- aminobenzoic acid ester of 2-hydroxy-4-(2-hydroxyethoxy)- benzophenone, 4-N,N-(2-ethylhexyl)methyl aminobenzoic acid ester of 4-(2-hydroxyethoxy)dibenzoylmethane, and mixtures thereof.

14. The microcapsules of claim 11 wherein said sunscreen agent is selected from octylmethoxy cinnamate, 3-butylmethoxydibenzoyl methane, benzophenone-3, 2-ethylhexyl-2-cyano-3,3-diphenylacrylate, and mixtures thereof.
15. The microcapsules of claim 9 wherein said dye is a fluorescent dye.
16. The microcapsules of claim 15 wherein said fluorescent dye is selected from Nile red, perylene, anthracene, pyrene, and mixtures thereof.
17. The microcapsules of claim 1 wherein said precursors are selected from metal alkoxide monomers, semi-metal alkoxide monomers, metal ester monomers, semi-metal ester monomers and from monomers of the formula  $M(R)_n(P)_m$ , wherein M is a metallic or semi metallic element, R is a hydrolysable substituent, n is an integer from 2 to 6, P is a non polymerizable substituent and m is an integer from 0 to 6, a partially hydrolyzed and partially condensed polymer thereof, and any mixture thereof.
18. The microcapsules of claim 17 wherein said metallic or semi metallic element is selected from Si, Ti, Zr, Al, and Zn
19. The microcapsules of claim 17 wherein said precursors are selected from silicon alkoxide monomers, silicon ester monomers, monomers of the formula  $Si(R)_n(P)_m$ , where R is a hydrolysable substituent, n is an integer from 2 to 4, P is a non polymerizable substituent and m is an integer from 0 to 4, a partially hydrolyzed and partially condensed polymer thereof, and any mixture thereof.

20. The microcapsules of claim 1 wherein said precursor is selected from metal alkoxide monomer, semi metal alkoxide monomer, a partially hydrolyzed and partially condensed polymers thereof and any mixture thereof.
21. The microcapsules of any one of claims 17-20 wherein said semi metal alkoxide monomer is silicon alkoxide monomer.
22. The microcapsules of claim 19 or 21 wherein said silicon alkoxide monomer is selected from tetramethoxy silane, tetraethoxy silane, and mixtures thereof.
23. The microcapsules of claim 19 or 21 wherein said silicon alkoxide monomer is tetraethoxy silane.
24. The microcapsules of claim 1 wherein said active ingredient is a sunscreen agent and said precursor is tetraethoxy silane.
25. The microcapsules of claim 1 wherein the particle size of the microcapsules is in the range of 0.01-1000  $\mu\text{m}$  in diameter.
26. The microcapsules of claim 1 wherein the particle size of the microcapsules is 0.1-100  $\mu\text{m}$  in diameter.
27. The microcapsules of claim 1 wherein the particle size of the microcapsules is 0.1-10  $\mu\text{m}$  in diameter.
28. The microcapsules of claim 1 wherein said microcapsules are non-leaching when dispersed in a carrier.
29. A composition comprising microcapsules as defined in any one of the preceding claims and a carrier.

30. The composition of claim 29 wherein said microcapsules are dispersed in said carrier.
31. The composition according to claim 29 wherein said carrier is a cosmetic carrier, a pharmaceutical carrier, a food carrier or a carrier used in agriculture or industrial processes.
32. The composition of claim 29 wherein said carrier is a liquid, a semi solid or a solid carrier.
33. A suspension, substantially free of colloidal silica, comprising microcapsules as defined in any one of claims 1-28.
34. The suspension of claim 33 consisting essentially of said microcapsules.
- 35.. The suspension of claim 33 wherein said suspension is dispersed in a carrier.
36. The suspension of claim 35 wherein said carrier is a cosmetic carrier, a pharmaceutical carrier, a food carrier or a carrier used in agriculture or industrial processes.
37. The suspension of claim 36 wherein said carrier is a liquid, a semi solid or a solid carrier.
38. The suspension of claim 33 wherein said microcapsules are non-leaching in the medium of the suspension.
39. The suspension of claim 33 wherein said microcapsules are non-leaching when said suspension is dispersed in a carrier.

40. A process for preparing microcapsules having a core material encapsulated within a microcapsular shell, said core material comprises at least one active ingredient,  
said process comprising the step of;

preparing an oil-in-water emulsion by emulsification of an oily phase, comprising a water insoluble precursor and the core material, in an aqueous phase, comprising an aqueous solution having a pH in the range 2-7, under appropriate shear forces and temperature conditions;

the process comprising at least one of the following conditions:

- (i) the concentration of the oily phase based on the total weight of the emulsion is from 50% to 90% w/w;
- (ii) the weight ratio of the precursors to the core material is from 5/95 to 25/75;

thereby obtaining microcapsules having above 95% w/w of said core material.

41. The process of claim 40 comprising a combination of the two conditions (i) and (ii).

42. The process of claim 40 comprising condition (ii).

43. The process of claim 40 further comprising the step of mixing and stirring said emulsion with another aqueous solution at a suitably selected pH in the range 2-7, to obtain loaded microcapsules in a suspension.

44. The process of claim 40 or 43 wherein the pH of the aqueous solution of is in the range 2 – 5.

45. The process of claim 40 or 43 wherein the pH of the aqueous solution is in the range 3-4.

46. The process of claim 40 comprising:

- (a) mixing a core material and a precursor forming an oily phase;
- (b) emulsifying said oily phase in an aqueous phase having a pH in the range 2-7 to form an oil-in water emulsion; and
- (c) stirring the product obtained in step (b) until microcapsules are formed.

47. The process of claim 40 comprising:

- (a) mixing a core material and a precursor in a production reactor forming an oily phase;
- (b) adding an aqueous phase having a pH in the range 2-7 to the production reactor in step (a) to form an oil-in water emulsion; and
- (c) stirring the product obtained in step (b) until microcapsules are formed.

48. The process according to any one of claims 40-47 wherein the process is conducted in one production reactor.

49. The process of claim 46 or 47 wherein said aqueous phase includes a surfactant.

50. The process according to any one of claims 46-49 further comprising adding a catalyst after step (b).

51. The process of claim 46 or 47 further comprising the step of adding an ingredient selected from a surfactant, a catalyst and a mixture thereof after step (b).

52. The process of claim 51 further comprising the step of diluting with an aqueous diluent after adding said ingredient.

53. The process of claim 49 or 51 wherein said surfactant is selected from a cationic surfactant, an anionic surfactant, a non-ionic surfactant and mixtures thereof.

54. The process of claim 49 or 51 wherein said surfactant is a cationic surfactant.

55. The process of claim 54 wherein said cationic surfactant is cetyltrimethyl ammonium chloride.

56. The process of claim 50 or 51 wherein said catalyst is an acidic solution.

57. The process of claim 56 wherein said acidic solution is an hydrochloric acid solution.

58. The process of any one of claims 46-57 wherein the pH of the aqueous phase is above 5 and said catalyst is added to provide a pH in the range of 2-5.

59. The process of any one of claims 46-57 wherein the pH of the aqueous phase is above 4 and said catalyst is added to provide a pH in the range of 3-4.

60. The process of any one of the preceding claims further comprising the step of isolating and rinsing the microcapsules through procedures selected from at least one of: separation by centrifuge; filtration; evaporation; re-suspension in aqueous medium; and dialysis.

61. The process of any one of the preceding claims wherein the suspension obtained is stabilized by adding additives selected from non-ionic, cationic or anionic polymers or surfactants or mixtures thereof.

62. The process of any one of the preceding claims further comprising the step of removing the water to obtain the final product in a powder form.

63. The process of any one of the preceding claims further comprising the step of adding reconstitution additives.

64. The process of claim 63 wherein said reconstitution additives are selected from non-ionic, cationic, anionic surfactants or polymers and mixtures thereof.

65. The process of claim 40 wherein said temperature is in the range of 5-20°C.

66. The process of claim 40 wherein the concentration of the oily phase in the emulsion is from 50% to 80% (w/w).

67. The process of claim 40 wherein the concentration of the oily phase in the emulsion is from 50% to 70% (w/w).

68. The process of claim 40 wherein the concentration of the oily phase in the emulsion is from 55% to 70% (w/w).

69. The process of claim 40 wherein the concentration of the oily phase in the emulsion is from 60% to 70% (w/w).

70. The process of claim 40 wherein the concentration of the oily phase in the emulsion is from 65% to 70% (w/w).

71. The process of claim 40 wherein the weigh ratio of the precursors to the core material is from 5/95 to 20/80.

72. The process of claim 40 wherein the weigh ratio of the precursors to the core material is from 5/95 to 15/85.

73. The process of claim 40 wherein the weigh ratio of the precursors to the core material is from 10/90 to 15/85.

74. The process of claim 40 wherein the weigh ratio of the precursors to the core material is from 10/90 to 15/85 and the pH of said aqueous solution is 3-4.

75. The process of claim 40 wherein the concentration of the core material based total weight of the microcapsules is from 95% to 99% (w/w).
76. The process of claim 40 wherein the concentration of the core material based total weight of the microcapsules is from 95% to 98% (w/w).
77. The process of claim 40 wherein said core material consists essentially of said at least one active ingredient.
78. The process of claim 40 wherein said core material is said at least one active ingredient.
79. The process of claim 40 wherein said core is a liquid core.
80. The process of claim 79 wherein said liquid core is an oily core.
81. The process of claim 80 wherein said oily core is a solution, suspension or dispersion.
82. The process of claim 40 wherein the active ingredient is selected from sunscreen agents, dental agents, fragrances, perfume, colors and dyes, food colors, food additives, waxes, antioxidants, humidifiers, vitamins, explosives, pesticides, biological molecules, drugs, catalysts, reagents, and mixtures thereof.
83. The process of claim 82 wherein said drug is selected from dermatological agents, anti-inflammatory agents, analgesics, anti-fungal agents, anti-biotics, anti-viral agents, anti-acne agents, anti histamines, skin whitening agents, anti-parasitic agents, muscle relaxants, steroids, hormones, astringents, and mixtures thereof.

84. The process of claim 40 wherein said active ingredient is a sunscreen agent.

85. The process of claim 84 wherein said sunscreen agent is selected from a UVA absorber, a UVB absorber, and mixtures thereof.

86. The process of claim 84 wherein said sunscreen agent is selected from octylmethoxy cinnamate, 3-butylmethoxydibenzoyl methane, benzophenone-3, benzophenone-1, benzophenone-2, benzophenone-4, benzophenone-6, benzophenone-8, 2-ethylhexyl p-methoxycinnamate, p-aminobenzoic acid, 2-ethylhexyl N, N-dimethyl-p-aminobenzoate, 2-cyano-3, 3-diphenylacrylic acid 2-ethylhexyl ester, 2-ethylhexyl-2-cyano-3,3-diphenylacrylate, oxybenzone, 2-phenylbenzimidazole-5-sulfonic acid, homomenthyl salicylate, octyl salicylate, 4,4'-methoxy-t-butylidibenzoylmethane, 4-isopropyl dibenzoylmethane, 3-(4-methylbenzylidene) camphor, 3-benzylidene camphor, triethanolamine salicylate, 4-N,N-(2-ethylhexyl)methyl aminobenzoic acid ester of 2,4-dihydroxybenzophenone, 4-N,N-(2-ethylhexyl)methyl aminobenzoic acid ester of 4-hydroxydibenzoylmethane, 4-N,N-(2-ethylhexyl)methyl- aminobenzoic acid ester of 2-hydroxy-4-(2-hydroxyethoxy)- benzophenone, 4-N,N-(2-ethylhexyl)methyl aminobenzoic acid ester of 4-(2-hydroxyethoxy)dibenzoylmethane, and mixtures thereof.

87. The process of claim 84 wherein said sunscreen agent is selected from octylmethoxy cinnamate, 3-butylmethoxydibenzoyl methane, benzophenone-3, 2-ethylhexyl-2-cyan-3,3-diphenylacrylate, and mixtures thereof.

88. The process of claim 82 wherein said dye is a fluorescent dye.

89. The process of claim 88 wherein said fluorescent dye is selected from Nile red, perylene, pyrene, anthracene, and mixtures thereof.

90. The process of claim 40 wherein said precursors are selected from metal alkoxide monomers, semi-metal alkoxide monomers, metal ester monomers, semi-metal ester monomers and from monomers of the formula  $M(R)_n(P)_m$ , wherein M is a metallic or semi metallic element, R is a hydrolysable substituent, n is an integer from 2 to 6, P is a non polymerizable substituent and m is an integer from 0 to 6, a partially hydrolyzed and partially condensed polymer thereof, and any mixture thereof.

91. The process of claim 90 wherein said metallic or semi metallic element is selected from Si, Ti, Zr, Al, and Zn.

92. The process of claim 90 wherein said precursors are selected from silicon alkoxide monomers, silicon ester monomers, monomers of the formula  $Si(R)_n(P)_m$ , where R is a hydrolysable substituent, n is an integer from 2 to 4, P is a non polymerizable substituent and m is an integer from 0 to 4, a partially hydrolyzed and partially condensed polymer thereof, and any mixture thereof.

93. The process of claim 40 wherein said precursor is selected from metal alkoxide monomer, semi metal alkoxide monomer, a partially hydrolyzed and partially condensed polymers thereof, and any mixture thereof.

94. The process of any one of claims 90-93 wherein said semi metal alkoxide monomer is silicon alkoxide monomer.

95. The process of claim 92 or 94 wherein said silicon alkoxide monomer is selected from tetramethoxy silane, tetraethoxy silane, and mixtures thereof.

96. The process of claim 92 or 94 wherein said silicon alkoxide monomer is tetraethoxy silane.

97. The process of claim 40 wherein said active ingredient is a sunscreen agent and said precursor is tetraethoxy silane.
98. The process of claim 40 wherein the product obtained is a suspension of said microcapsules.
99. The process of claim 40 wherein the product obtained is a powder of said microcapsules.
100. The process of claim 40 wherein the particle size of the microcapsules is in the range of 0.01-1000  $\mu\text{m}$  in diameter.
101. The process of claim 40 wherein the particle size of the microcapsules is 0.1-100  $\mu\text{m}$  in diameter.
102. The process of claim 40 wherein the particle size of the microcapsules is 0.1-10  $\mu\text{m}$  in diameter.
103. The process of claim 40 wherein the microcapsules obtained by said process are non-leaching.
104. The process of claim 40 wherein the product obtained by said process is a suspension of said microcapsules in the reaction medium of said process.
105. The process of claim 104, wherein said suspension is substantially free of colloidal silica.
106. The process of claim 40 further comprising the step of dispersing the obtained microcapsules in a carrier.

107. The process of claim 40 further comprising the step of dispersing the obtained microcapsular suspension in a carrier without the need of purifying said suspension.

108. The process of claim 106 wherein said carrier is a cosmetic carrier, a pharmaceutical carrier, a food carrier, a carrier used in agriculture or industrial processes.

109. The process of claim 105 wherein said carrier is a liquid, a semi solid or a solid carrier.